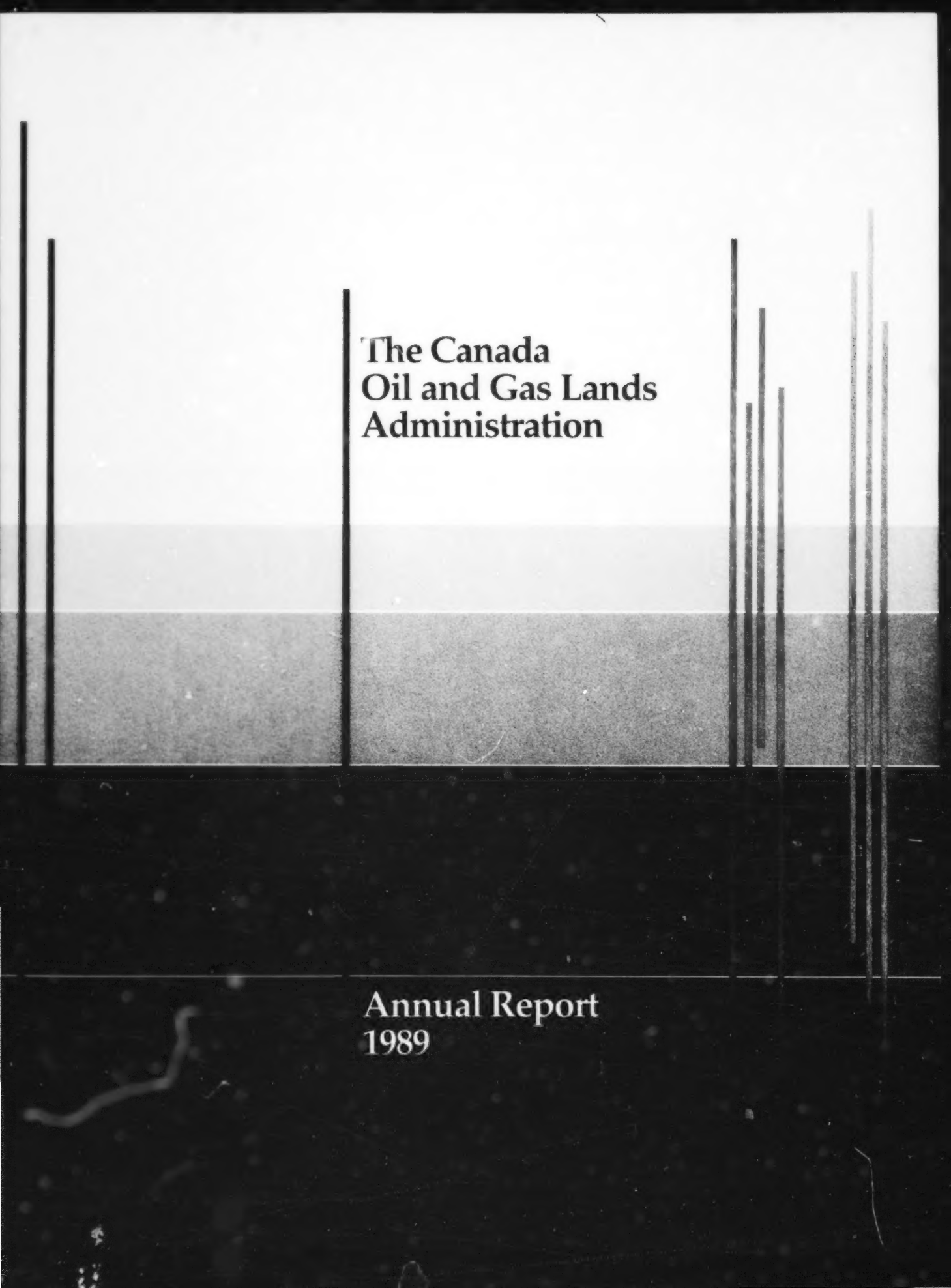

The Canada Oil and Gas Lands Administration

Annual Report 1989

90-06612/

Corporate Profile

The Canada Oil and Gas Lands Administration (COGLA) was established in 1981 by a memorandum of understanding between the Minister of Energy, Mines and Resources and the Minister of Indian Affairs and Northern Development.

COGLA is the federal government's principal contact with the oil and gas industry in matters relating to the regulation of oil and gas activity on Canada's frontier lands. These lands include Yukon Territory, the Northwest Territories, Hudson Bay and most of the country's offshore areas. The Canada-Newfoundland Offshore Petroleum Board has operational responsibility for the Newfoundland and Labrador offshore. A new Canada-Nova Scotia Offshore Petroleum Board with operational responsibility for the Nova Scotia offshore will be established when legislation implementing the Canada-Nova Scotia Accord is proclaimed in the new year.

COGLA's prime responsibility is to regulate the exploration for, and the development and production of, oil and gas on frontier lands in a manner that promotes safety of the worker, effective resource conservation, environmental protection, and full and fair access for Canadians to benefits and opportunities. COGLA has five branches:

- Rights Management Branch
- Engineering Branch
- Resource Evaluation Branch
- Environmental Protection Branch
- Policy Analysis and Coordination Branch

COGLA's Yellowknife office has operational responsibility for the northern offshore and onshore areas. This office regulates the geological and engineering, and Canada Benefits aspects of oil and gas exploitation activities, by issuing authorizations to drill wells, by monitoring reports and other data submitted on operations, and by conducting regular on-site inspections.

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Messages from the Ministers

Jake Epp, Minister of Energy, Mines and Resources

I am pleased to submit to Parliament the eighth annual report of the Canada Oil and Gas Lands Administration (COGLA). This agency is responsible for regulating oil and gas activities in areas of Canada's frontier lands not under joint management regimes. COGLA also provides advice and information to the federal government on petroleum industry activities.

When this government came to power in September 1984, it moved swiftly to replace the National Energy Program and to introduce a sensitive, market-oriented approach to energy issues. Part of that process was the introduction of the Frontier Energy Policy of 1985: a policy designed to bring back a sense of unity, cooperation and fairness between governments and the industry in matters relating to frontier oil and gas activities.

In addition, we have completed the process of negotiating and implementing offshore energy accords with Newfoundland and Nova Scotia. These accords have been enshrined in law and Offshore Petroleum Boards have been established in each province. Agreements in principle on a Northern Accord with the two territories have been signed, and discussions about a potential Pacific Accord with British Columbia have been held. Our objective continues to be the creation of a consistent, equitable and stable regulatory regime for the petroleum industry operating on the frontier lands.

The challenge of the 1990s will be to ensure that a market-oriented and deregulated energy industry is able to respond to public concerns about the protection of the environment through increased government/industry cooperation and research on matters dealing with oil spill prevention and countermeasures.

I look forward in meeting the challenges of the future with you.

Tom Siddon, Minister of Indian and Northern Affairs

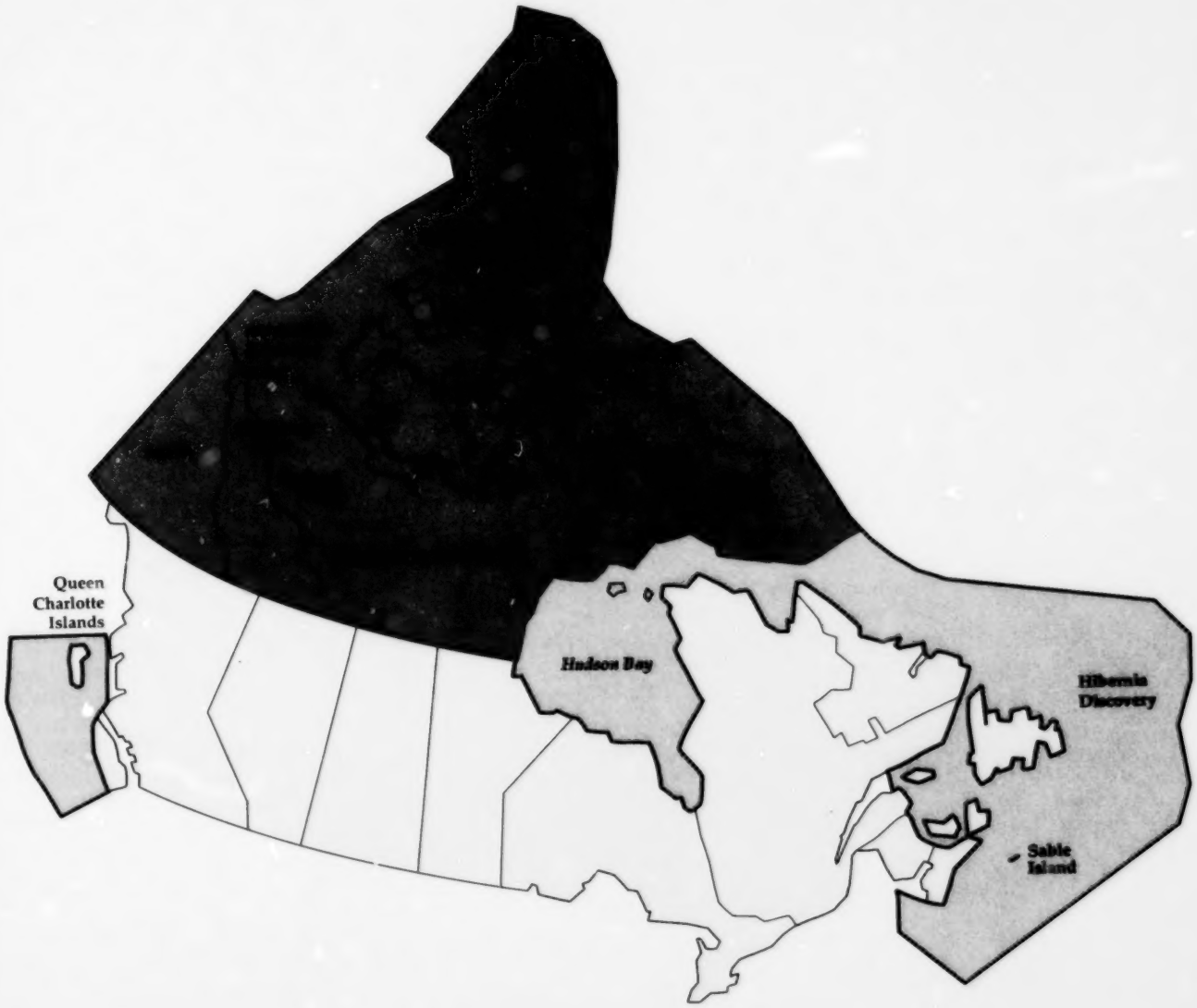
I am pleased to join my colleague, the Honourable Jake Epp, Minister of Energy Mines and Resources, in submitting to Parliament the eighth annual report of the Canada Oil and Gas Lands Administration (COGLA).

1989 was a year of continued progress under the *Northern Political and Economic Framework*. Approved by the federal government in 1987, this framework is based on the principle of joint action with northerners to build a stronger, environmentally sustainable, North. The agreements in principle on a future northern accord signed with the territorial governments in 1988 are an integral part of the framework. In the spirit of these agreements in principle, the territorial governments were consulted prior to the May 1989, decision to proceed with the issuance of new oil and gas exploration rights in the central Beaufort Sea. The issuance of these exploration rights is subject to specific requirements for environmental protection and opportunities for northerners.

Comprehensive environmental protection measures and safeguards have long been in place for northern oil and gas activities. Further refinements for Beaufort Sea exploration activities were made in 1989, following a review of emergency preparedness, relief well and compensation requirements, by the Environmental Impact Review Board, a government-Inuvialuit body.

My government is fully committed to the task of protecting the environmental integrity of the North while continuing to work with all northerners to foster sustainable economic development.

Canada's Frontier Lands



Area under the responsibility of the
Minister of Energy, Mines and Resources

Area under the responsibility of the
Minister of Indian Affairs and Northern Development

A Word from COGLA's Administrator, Maurice Taschereau

Mr. Maurice Taschereau

The northern region was the most active area on the frontier lands in 1989 with 12 active wells, 5 in the Beaufort Sea and 7 on the Mainland Territories. Twenty geophysical projects were carried out in the region during the year by industry in preparation for future drilling and exploration programs.

In the spirit of the September 1988 agreements in principle on a Northern Accord, the federal and territorial governments cooperated to establish terms and conditions for the first issuance of new oil and gas exploration rights in the Beaufort Sea in nearly 20 years. In May the Minister of Indian Affairs and Northern Development called on industry to nominate lands in the Beaufort Sea. After a favorable response by industry, a call for bids was issued in November inviting companies to submit bids for three parcels of land by 9 March 1990. This important initiative will provide industry with new exploration rights throughout the 1990s for the central Beaufort Sea area.

New exploration rights were also issued by the Canada-Newfoundland Offshore Petroleum Board (CNOPB) and the Canada-Nova Scotia Oil and Gas Board on the East Coast. CNOPB issued five exploration licences offshore Newfoundland as a result of a 1989 call for bids. Three exploration agreements were issued to industry by the Canada-Nova Scotia Oil and Gas Board as a result of a call for proposals.

In August the ministers of Indian Affairs and Northern Development, and Energy, Mines and Resources announced the appointments of a chairman and four members to the Oil and Gas Committee. The committee was reactivated to hear two appeals on proposed significant discovery areas near Fort Liard, N.W.T. and in the Beaufort Sea.

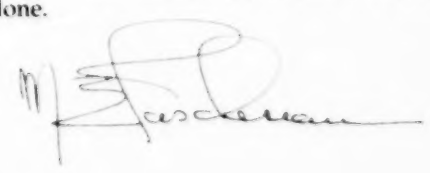
In April H. James Strain was appointed Chairman of CNOPB, replacing J.E. (Ted) Baugh upon his retirement. Mr. Baugh played a key role in establishing the board and guiding its development to full operational status.

COGLA continued to consult with industry, governments and CNOPB on regulatory initiatives. Of particular importance is the work on the draft Certificate of Fitness Regulations accomplished by a panel of senior officials from COGLA, the accord provinces and CNOPB. These regulations are part of the federal government's follow-up to the recommendations of the Ocean Ranger Commission. The regulations list organizations which were approved by the panel as Certifying Authorities qualified to certify any type of offshore installation facility in Canada. At year-end the regulations were being reviewed with industry.

This year oil spills off the West Coast and in Alaskan waters, and the resulting public and media attention to the subject, resulted in a thorough reassessment of existing regulatory regimes. While the environmental requirements in COGLA's drilling approval process are among the most stringent in the world, we continue to carefully review all aspects of prevention, containment, contingency planning, countermeasures and compensation provisions for drilling-related pollution.

The joint government-Inuvialuit Environmental Impact Review Board (IERB) conducted its first public hearing on an exploratory well in the Beaufort Sea, Esso Chevron Isserk I-15. The review board made several recommendations which COGLA reviewed and incorporated into the Isserk I-15 drilling program approval. In December we held a workshop with the Inuvialuit on safe drilling practices for offshore oil and gas exploration.

As a result of changes in the frontier lands management regime and the low level of exploration activities, COGLA's size and structure were adjusted to meet ongoing responsibilities. I would like to thank our staff for their continuing support and for a job well done.



Federal-Provincial-Territorial Management of the Frontier Lands

Offshore Accords

The federal government signed offshore accords with the Government of Newfoundland and Labrador in 1985, and with the Government of Nova Scotia in 19 . Each accord sets out an arrangement whereby the federal and provincial governments agree to jointly manage petroleum activities in the offshore, and to share revenues from the exploration and development of petroleum resources.

The federal and provincial accord implementation acts incorporate the provisions of the Canada Petroleum Resources Act and the Oil and Gas Production and Conservation Act, thus ensuring a consistent regulatory regime throughout the offshore areas. As well, the regulations under each accord implementation act correspond closely to those in effect elsewhere on frontier lands.

Each offshore accord establishes an independent board to manage an offshore area on behalf of Canada and the province. The boards are under the authority of federal and provincial energy ministers, who review fundamental decisions of the boards.

COGLA's role in implementing the accords is to help transfer responsibilities to the independent boards and to provide advice and coordination on behalf of the federal energy minister.

Newfoundland and Labrador

The Canada-Newfoundland Offshore Petroleum Board (CNOPB), in St. John's, Newfoundland, regulates the operations of petroleum activities in the Newfoundland offshore on behalf of the Government of Canada and the Government of Newfoundland and Labrador. CNOPB publishes an annual report on its operations for its fiscal year, which ends 31 March.

Mr. H. James Strain was appointed Chairman of CNOPB, effective 17 April 1989. He replaced Mr. J.E. (Ted) Baugh, the board's first chairman, when Mr. Baugh retired.

In 1989 federal, provincial and CNOPB representatives finalized a memorandum of understanding (MOU), which sets out roles and responsibilities of CNOPB and government departments and agencies for industrial and employment benefits matters with respect to the design and construction of offshore projects. At year-end the MOU was being circulated to federal and provincial ministers and the CNOPB chairman for signature. In addition, MOUs on marine safety, and occupational health and safety were finalized by federal and provincial government agencies and the board.

During 1989 negotiations continued between the Government of Canada, the Government of Newfoundland and Labrador, and the Hibernia Project consortium on a final agreement to develop the Hibernia oilfield offshore Newfoundland. An agreement is expected in 1990 and initial production is scheduled to begin in 1996.

Federal-Provincial-Territorial Management of the Frontier Lands

Nova Scotia

The Canada-Nova Scotia Offshore Oil and Gas Board, established under the 1982 Canada-Nova Scotia Agreement on Offshore Oil and Gas Resource Management and Revenue Sharing, met for the last time in June.

The Oil and Gas Board will be replaced by a new Canada-Nova Scotia Offshore Petroleum Board when the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act and corresponding provincial legislation are proclaimed in 1990.

At year-end, the federal and provincial governments were considering appointments to the new board. The board will comprise a jointly appointed chairperson and four part-time members, two appointed by each government.

British Columbia

The federal and provincial governments continued to follow up on the various recommendations of the West Coast Offshore Exploration Environmental Assessment Panel Report. At year-end the prohibitions on offshore petroleum exploration activity were still in effect.

Northwest Territories and Yukon

In September 1988 the Government of Canada and the governments of Yukon and the Northwest Territories signed agreements in principle for a Northern Accord. In the spirit of these agreements, throughout 1989 COGLA officials consulted regularly with representatives of both governments on regulatory decisions. COGLA also briefed officials of each government on regional geology, resource potential, significant discoveries, existing rights and current regulatory processes.

Rights Management

COGLA issues, regulates and registers oil and gas exploration and production rights in Canada's North and in offshore frontier areas not overseen by regional boards, under the authority of the ministers of Indian Affairs and Northern Development, and Energy, Mines and Resources. COGLA also administers federal mineral rights situated within the provinces under the authority of the Minister of Energy, Mines and Resources.

In May COGLA issued a call for nominations in the central Beaufort Sea, signaling to industry that the Minister of Indian Affairs and Northern Development, in cooperation with the two territorial governments, was preparing to issue oil and gas exploration rights in the Beaufort Sea. Previous exploration rights in the area were awarded 20 years ago. The call for nominations closed in September and subsequently a call for bids for three parcels, comprising more than 100 000 hectares, was issued. The call will close 9 March 1990. The sole bidding criterion to be used to assess and select successful bids is the total amount of money the bidder proposes to spend in the first four years of the term of the licence.

Elsewhere, six exploration licences and three exploration agreements were issued in 1989. Following a call for bids that closed in September, CNOPB awarded five exploration licences offshore Newfoundland. CNOPB received total work expenditure bids of more than $49 million for the call.

A second generation exploration licence was issued in the Beaufort Sea to Gulf Canada Resources Ltd. The licence requires the drilling of three wells during the four-year term.

Following a call for proposals that ended in June, the Canada-Nova Scotia Offshore Oil and Gas Board awarded three exploration agreements for rights near Sable Island. The board received total work expenditure bids of more than $19 million.

COGLA issued six significant discovery licences (SDLs) in 1989 related to significant discovery area (SDA) declarations in the central Beaufort Sea.

At year-end, industry held 5.69 million hectares of frontier lands, comprising 49 exploration agreements and exploration licences, 98 SDLs and 2 production licences.

CNOPB administered rights held under 11 exploration licences and 10 SDLs. The Canada-Nova Scotia Oil and Gas Board administered rights held under 3 new exploration agreements and 22 SDAs.

In 1989 COGLA continued to consult industry, accord provinces, territorial governments and offshore boards on developing regulations under the Canada Petroleum Resources Act for royalties, surveys and Canadian ownership, and on related guidelines, forms and procedures.

Rights Management

FRONTIER LAND HOLDINGS AT YEAR-END, 1989	1985	1986	1987	1988	1989
Number of Licences/Agreements Active*	150	118	112	153	149
Lands Negotiated into Licences/Agreements (millions of ha)	24.9	4.1	7.3	2.31	0.56
Lands Relinquished or Surrendered (millions of ha)	20.0	39.2	15.1	16.5	2.37
Lands Active (millions of ha)	70.8	33.5	20.6	7.1	5.69

** Includes exploration licences, exploration agreements, significant discovery licences and production licences.*

LAND STATUS AT YEAR-END, 1989

	Active Licences/ Agreements*	Lands Relinquished or Surrendered (millions of ha)	Lands Negotiated into Licences/ Agreements (millions of ha)	Lands Active (millions of ha)	Pending Lands** (millions of ha)
Mainland Territories	25	0.38	0	0.9	1.1
Mackenzie Delta and Beaufort Sea	62	1.4	0.2	2.5	0
Arctic Islands and Eastern Arctic Offshore	24	0.17	0	1.29	2.4
Hudson Bay	0	0	0	0	1.4
Newfoundland Offshore	21	0.3	0.26	0.76	1.5
Nova Scotia Offshore (Includes Gulf of St. Lawrence)	17	0.12	0.1	0.24	3.4
West Coast	0	0	0	0	8.7
Total	**149**	**2.37**	**0.56**	**5.69**	**18.5**

** Includes exploration licences, exploration agreements, significant discovery licences and production licences.*

*** 'Pending' includes areas where exploration activity has been suspended: West Coast, Baffin Bay, Georges Bank, St. Pierre and Miquelon, etc.*

LICENCES/AGREEMENTS NEGOTIATED IN 1989

Operating Company	Licence/ Agreement	Number of Licences/ Agreements*	Area (thousands of ha)	Location	Term (years)
Gulf	EL 351	1	244	Beaufort Sea	4
LASMO	EA 352	1	26	Nova Scotia	6
Nova Scotia Resources	EA 353	1	18	Nova Scotia	6
Mobil	EA 354	1	55	Nova Scotia	6
Gulf	SDL 083-088	6	42	Beaufort Sea	—
Esso Resources (1989)	EL 1003	1	42	CNOPB	6
Shell	EL 1004	1	52	CNOPB	6
Petro-Canada	EL 1005	1	55	CNOPB	6
BP Resources	EL 1006	1	37	CNOPB	6
Petro-Canada	EL 1007	1	77	CNOPB	9

* *Includes exploration licences and significant discovery licences.*

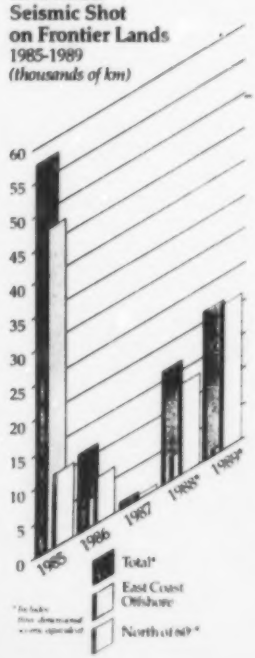
Exploration Activity

Esso Chevron et al. Nipterk P-32 drilled from an artificial ice island in the Beaufort Sea
Courtesy, K. Singh

In 1989, 14 exploratory wells were active on frontier lands. This was a decrease over 1988, and reflected the trend toward decreasing activity on frontier lands because of low oil prices and shrinking land holdings. Exploration activity highlights included the continuing exploratory work in the Beaufort Sea and the announcement of significant discoveries in the Beaufort Sea and in the Newfoundland offshore.

Geophysical activity remained at the same level as in 1988, and occurred in all areas except the Arctic Islands and offshore Newfoundland.

Reflection Seismic Shot on Frontier Lands
1985-1989
(thousands of km)



The North

Almost all of the frontier geophysical work and 12 of the 14 active wells on Canada's frontier lands were in the North in 1989, with the highlight being the continued exploration activity in the Beaufort Sea, particularly the western portion.

Beaufort Sea and Mackenzie Delta

Ice and weather conditions during the summer were generally good for collecting data. A total of 11 geophysical surveys were conducted, including two site-specific surveys and one three-dimensional seismic survey. Esso completed two small seismic surveys, a well-site survey in the Beaufort Sea, and one seismic survey onshore in the Mackenzie Delta. Shell conducted three surveys onshore in the Mackenzie Delta, including a three-dimensional seismic survey in the Niglintgak area. Amoco ran two surveys offshore, including a site survey, and Geophysical Services Inc. conducted a large regional survey in the Beaufort Sea. Chevron completed a small survey in the shallow waters north of Richards Island.

Four exploratory wells were completed in 1989, all in the Beaufort Sea. Esso Chevron et al. Nipterk P-32 was drilled from an artificial spray ice island north of Richards Island. The ice island was constructed in 6.5 m of water, making it the deepest spray ice island in the Canadian Beaufort Sea to date. It had a working surface diameter of 75 m, with a total diameter of 380 m. The well was completed in two months and was abandoned as an oil and gas discovery.

On 5 June the operator drilling the Gulf et al. Immiugak N-05 well in the Beaufort Sea encountered a shallow pocket of high-pressure natural gas, which blew the drilling fluid from the well-bore and escaped to the surface. The drilling unit, *Kulluk*, was evacuated when the flow could not be controlled, and was later removed from the well location because of deteriorating ice conditions. The operator, Gulf, moved the *Kulluk* slightly to the northeast and drilled Immiugak A-06, which was deviated to encounter the same primary objectives as N-05. The well was abandoned and the operator is keeping the results confidential.

Amoco et al. Kingark J-54 was also drilled in the Beaufort Sea, approximately 20 km northeast of the 1986 Adlartok oil discovery. Severe overpressuring problems occurred during drilling, so the operator required additional time to drill and test the well. The Kingark well was abandoned and data from this well remain confidential.

At year-end Esso Chevron et al. Isserk I-15 had reached a total depth of 2693 m and was undergoing evaluation.

Mainland Territories

Geophysical activity in the mainland territories increased slightly in 1989 with a total of nine geophysical projects, six of which were seismic, totaling 1600 km of new reflection data. In the Fort Good Hope area, Chevron undertook three programs involving gravity, resistivity and seismic surveys. Petro-Canada and Shell each conducted two seismic programs, Unocal conducted a small seismic project, and Northcor extended its large aeromagnetic survey of 1988.

Four exploratory wells were terminated in 1989. Shell et al. Arrowhead B-41, just north of the B.C.-N.W.T. border, was drilled to 3080 m and was suspended as a gas discovery. Conoco et al. Little Bear O-51, located south of Norman Wells, was abandoned without testing.

Paramount drilled two new wells in the Cameron Hills area, Paramount et al. Cameron L-47 and Cameron B-08; both wells were suspended for further evaluation in the upcoming drilling season. In addition, Paramount reentered the Cameron Hills I-10 well, drilled in 1986, to conduct more tests. Results from all three Cameron Hills wells remain confidential. Paramount et al. Cameron L-44 was spudded late in the year.

Chevron Mountain River O-18 was spudded in late November in the Fort Good Hope area and was drilling at year-end.

Arctic Islands

No geological, geophysical or drilling activity took place in 1989.

East Coast Offshore

Highlights of the East Coast offshore in 1989 include a successful gas discovery in the Jeanne d'Arc Basin, offshore Newfoundland, and a reflection seismic survey on the Scotian Shelf in the Cohasset area.

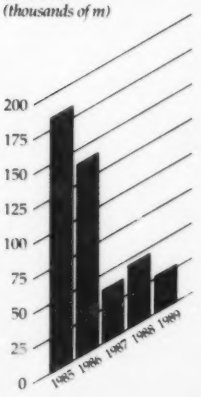
Newfoundland Offshore

In 1989 two exploratory wells were drilled in the Newfoundland offshore, completing a three-well drilling program started by Texaco in 1988. Texaco et al. Amethyst F-20 was drilled on the east side of the Jeanne d'Arc Basin, about 10 km northeast of the 1986 oil discovery at Fortune G-57 and was abandoned without testing. Texaco et al. Springdale M-29 was drilled on the southeastern edge of the Jeanne d'Arc Basin and tested gas at rates of up to 331 000 m^3 per day.

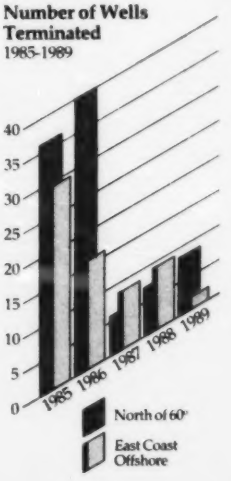
Nova Scotia Offshore

In 1989 LASMO Nova Scotia Ltd., a new operator on Canada's East Coast, and Nova Scotia Resources Ltd., conducted a regional seismic survey east of the Cohasset oil discovery. LASMO is evaluating its newly acquired exploration agreement. No exploratory or delineation wells were drilled offshore Nova Scotia in 1989.

Exploratory and Delineation Drilling on Frontier Lands
1985-1989
(thousands of m)



Number of Wells Terminated
1985-1989



Resource Evaluation Activities

Chevron conducting a seismic survey near Fort Good Hope, N.W.T.
Courtesy: Chevron Canada Resources Ltd.

Evaluation of Hydrocarbon Potential

In 1989 COGLA and the Institute of Sedimentary and Petroleum Geology embarked on two regional assessments of hydrocarbon resources: the part of the Western Canada Gas Assessment that extends into the Northwest Territories and Yukon to 62°N, and an assessment of the oil and gas potential of the Mackenzie Corridor. COGLA also reviewed drafts of the offshore Newfoundland Jeanne d'Arc Basin Assessment.

COGLA evaluated the results of geoscientific research in the Queen Charlotte Islands and Hecate Strait offshore British Columbia for hydrocarbon potential in the Queen Charlotte Basin, particularly the offshore area east of the proposed South Moresby Island marine park.

As part of its contribution to land-use planning in the Mackenzie Delta-Beaufort Sea region, COGLA prepared maps illustrating hydrocarbon prospectivity and development potential. COGLA also contributed technical information to the Mackenzie/Delta Geological Atlas, which is being developed by the Geological Survey of Canada. Also in 1989, COGLA conducted diverse studies on petroleum geology, geophysics and hydrocarbon potential, particularly in basins where exploration has been active (e.g., Beaufort/Mackenzie basin, the Mackenzie Corridor and the southern territories). These studies support many of COGLA's resource management responsibilities and have been aided by COGLA's computer-based data-handling systems.

Research

COGLA actively promotes research into improved techniques to evaluate wells drilled with oil-based mud. Two research contracts are under way that address concerns regarding the organic geochemistry and biostratigraphy of samples from such wells.

Oil and Gas Committee

In August the Minister of Indian Affairs and Northern Development and the Minister of Energy, Mines and Resources jointly announced the appointments of Dr. Edward (Ted) Best as chairman, and Laura Jean Nelson, Steven Malcolm Millan, Jacques Farmer and John Boyd as members of the Oil and Gas Committee. The committee is a quasi-judicial body that hears appeals and holds inquiries on technical matters relating to the Oil and Gas Production and Conservation Act, and advises the ministers on issues relating to the Canada Petroleum Resources Act. At year-end, the committee was preparing to hear appeals from two companies about proposed SDAs near Fort Liard, N.W.T. and in the Beaufort Sea.

Conservation and Development

Mainland Territories

Norman Wells

The waterflood project continued to show improvements, with an increased oil rate and reservoir pressure, and a decreased gas-oil ratio.

Aside from routine workovers, the only significant well activity was the conversion of one producer to an injector, which changed the field well count to 166 producers and 155 injectors.

Oil production in 1989 totaled 1.789 million m^3, an increase from 1.728 million m^3 in 1988. The daily average oil production rate increased slightly to 4900 m^3 per day. At year-end, cumulative oil production from the field was 12.138 million m^3. This cumulative amount includes an increase of 1.083 million m^3 due to recalibration of the 1988 production data.

Gas production continued to decline, with 129 million m^3 produced in 1989, compared with 138 million m^3 produced in 1988.

Pointed Mountain

In 1989 gas production from the Pointed Mountain gas field declined to 103 million m^3, representing a 33 per cent reduction over 1988. Cumulative gas production at year-end totaled 8.088 billion m^3.

Kotaneelee

Plans have been made to modify the gas plant at Kotaneelee, Yukon, in anticipation of better opportunities for gas contracts. The changes will improve plant efficiency and reduce the time necessary for plant start-up if gas contracts are negotiated.

Beaufort Sea - Mackenzie Delta

Mackenzie Delta Gas Export Project

Esso, Shell and Gulf each applied to the National Energy Board for export licences to carry natural gas from the Mackenzie Delta and Beaufort Sea to the United States. The licences would be for 20 years, beginning 1 November 1996. The producing companies expect to export 260 billion m^3 of gas. The fields will provide a sales rate of 34 million m^3 per day. COGLA completed a reservoir engineering analysis of the Taglu gas field and initiated a similar study on the Parsons Lake gas field.

Arctic Islands

Bent Horn

Panarctic again made two shipments of seasonal production from its Bent Horn oil field on Cameron Island. The first shipment of 24 637 m^3 left 5 September on the *MV Arctic*. About 1900 m^3 of the crude was transferred to the tanker *MV Ours Polaire* for use in Resolute; the rest was transferred to the *MV Kmir*, a Norwegian-registered vessel, which delivered the oil to Statoil in Denmark.

The *MV Arctic* picked up a second shipment of 18 444 m^3 on 24 September. Heavy ice in the area prevented the vessel from taking more crude in the second shipment. The crude was later transferred to the *MV Don*, a Norwegian-registered vessel, destined for Statoil.

Oil production from Bent Horn this year totaled 43 373 m^3. Cumulative production from the Bent Horn field is 180 000 m^3.

Nova Scotia Offshore

Cohasset and Panuke

LASMO and Nova Scotia Resources are preparing plans to produce oil from the Cohasset and Panuke discoveries, and are expected to submit a formal development plan application in 1990. Production could begin in 1992.

Bladders being filled with Bent Horn crude prior to loading into a tanker for shipment.
Courtesy, G. McCormick.

Protection of the Worker

COGLA personnel inspecting H2S scrubbers at the Paramount et al Canaport B-08 well site. Courtesy, K. Singh

In 1989 COGLA worked with the accord provinces and CNOPB to complete the legislative drafting instructions for safety amendments to the Oil and Gas Production and Conservation Act, the Atlantic Accord and the Canada-Nova Scotia Accord implementation acts. Once enacted, these proposed safety amendments will put into legislation the recommendations from the Royal Commission on the Ocean Ranger Marine Disaster that still require statutory implementation. The amendments include:

- a Certificate of Fitness system to ensure that facilities and equipment used by industry are verified as fit for service by a third party;
- a requirement that each offshore installation be under the command of an offshore installation manager who will be responsible for the safety of personnel and the facility or installation;
- a council to ensure consistent regulatory practices;
- temporary emergency power to the energy minister; and
- provisions to enhance the role of officers who inspect the safety of operations.

The Department of Justice is now drafting the proposed amendments into legislation.

Occupational Safety and Health

After extensive consultation with industry, COGLA published the Oil and Gas Occupational Safety and Health Guidance Notes in June. They give information to employers, employees and contractors on frontier lands to help them meet the requirements in Part II of the Canada Labour Code and its regulations. In particular, the document offers guidelines for forming safety committees and procedures to follow when employees refuse to do work they consider dangerous. The guidelines were sent to all oil and gas operators on the frontier lands.

In 1989 the drafting of the Newfoundland Petroleum Occupational Safety and Health Regulations was completed by COGLA and the Newfoundland Department of Mines and Energy. Industry also reviewed the regulations, which are similar to the federal Occupational Safety and Health Regulations. The regulations have now been finalized and will likely be promulgated in 1990.

Production

The draft Production Installation Regulations were renamed the Installations Regulations, and amended by COGLA to cover drilling, accommodation and production installations. These regulations include technical requirements for designing, constructing, installing, operating and maintaining an installation.

Certification

The Certificate of Fitness Regulations were drafted by COGLA and sent to industry for comments. These regulations are part of the certification process recommended by the Ocean Ranger commission and the subsequent Harrison Task Force Report. The regulations list organizations approved as certifying authorities (CAs), outline procedures for issuing a Certificate of Fitness, and include the minimum scope of work to be carried out by the CA.

During 1989 an executive panel was convened to hear applications for organizations wanting recognition as CAs. The panel included senior officials from COGLA, the Newfoundland Department of Mines and Energy, the Nova Scotia Department of Mines and Energy, and CNOPB.

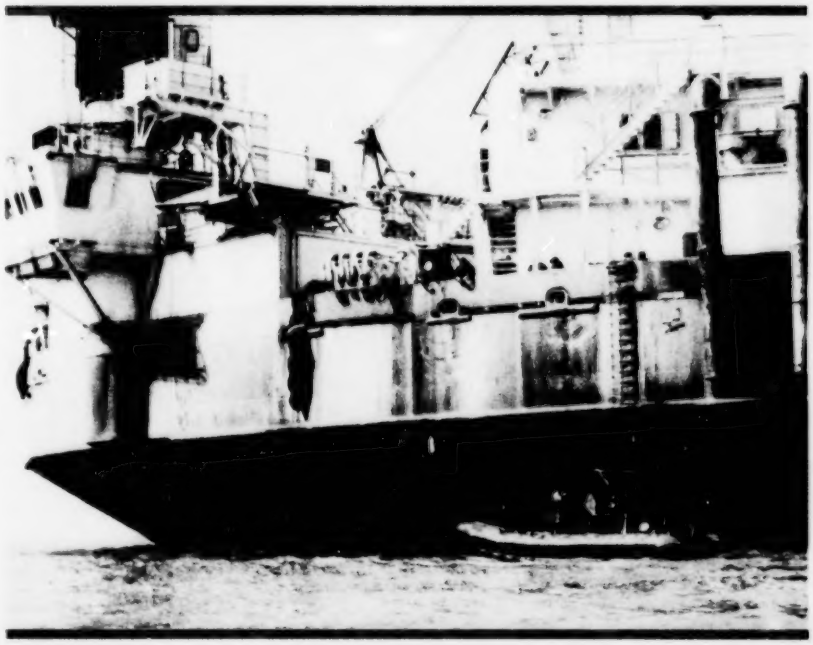
Important criteria in the qualification review process established by the panel were that CAs must have enough certification experience, resources and qualified staff to certify any offshore installation in Canada, and must be able to conduct surveys to ensure that an operator can maintain a valid Certificate of Fitness.

After evaluating several qualified organizations, the panel recommended the following companies be included in the Schedule of Recognized Certifying Authorities, which will be included in the proposed Certificate of Fitness Regulations:

- American Bureau of Shipping;
- Bureau Veritas;
- Det Norske Veritas; and
- Lloyd's Register of Shipping.

Standards for Survival Suit Systems

COGLA chairs the Survival Suits Committee, which is responsible for developing survival suit standards. As a result of the work of that committee, in 1989 the Canadian General Standards Board published standards for marine abandonment immersion suit systems and for marine anti-exposure work suit systems. Operators have a reasonable amount of time to comply with these standards.



Drilling crew upgrading the Kulluk at the Immagak N-05 well site in the Beaufort Sea. Courtesy: D. Scratch

Safety Training

In 1989 COGLA, CNOPB and industry continued to develop training and qualification guidelines describing the minimum safety and industrial training required by mobile offshore drilling unit (MODU) personnel and standby vessel crews. These guidelines will help operators apply the training provisions of various occupational safety and health, marine and drilling regulations. These guidelines received general support from industry and will be published in 1990.

Also in 1989 COGLA extended the Survival Training Guidelines to include all regular northern offshore workers. This training gives personnel a basic understanding of the hazards associated with the offshore environment, and training in emergency equipment and in skills needed to react effectively to offshore emergencies. Industry accepted the guidelines and a standard training program was developed with the Pacific Marine Training Institute, the delivery agency of the program, in Vancouver. At year-end, most northern offshore personnel had taken the course.

Protection of the Worker

Abandonment operation underway at the Bent N-T. Fielding Lake No. 1 well in the Northwest Territories. Courtesy, E. Lepine.

Diving

During 1989 COGLA completed work on 10 sets of diving training guidelines and requirement standards, to meet specific sections of the Canada Oil and Gas Diving Regulations. These guidelines will require uniform training for divers and other diving personnel to ensure that diving operations on frontier lands are safe. All training guidelines will be published and distributed in early 1990.

Blowout Prevention Committee

COGLA serves on the Blowout Prevention and Well Control Examination and Certification Committee, a body that includes representatives from provincial regulatory agencies and industry. In 1989 the committee revised the course content for the certification of personnel on land wells. As well, the committee now allows candidates with valid land certificates the flexibility to take the offshore, severe service (H_2S) or well service courses as refresher courses. In late 1989 the committee initiated a review of the courses required for offshore certification.

Marine

In 1989 the Canadian Coast Guard, with COGLA's participation, completed drafting the Certification and Manning Regulations, which outline the training qualifications and manning requirements of marine supervisory staff on MODUs or production vessels. They are expected to be promulgated in 1990.

Inspections

As part of COGLA's mandate to ensure the safety and health of employees and the effectiveness of oil and gas operations on frontier lands, periodic inspections are carried out on all exploration and production sites. In 1989, 3 geophysical, 25 drilling and 5 production facilities were inspected on the frontier lands.

Lost-Time Accidents

In 1989 a total of 21 lost-time accidents (LTAs) on exploration sites and standby vessels were reported to COGLA safety officers. This resulted in an increase in the incidence of LTAs to 18.6 per million person/hours worked, from15.1 in 1988. In addition, 1 production and 10 geophysical-related LTAs occurred on the frontier lands. There were no fatalities associated with oil and gas exploration or production during the year.

LOST-TIME ACCIDENTS ON FRONTIER LANDS, 1989

	Person-Hours at Work Site		Lost-Time Accidents		Accident Rate	
	Drilling Unit	Standby/ Supply Vessel	Drilling Unit	Standby/ Supply Vessel	Drilling Unit	Standby/ Supply Vessel
					(LTA/Millions of Person-Hours)	
Mainland Territories	90 997	—	1	—	11	—
Mackenzie Delta* and Beaufort Sea	565 054	289 944	8	4	14.16	13.80
Arctic Islands and Eastern Arctic Offshore	—	—	—	—	—	—
Newfoundland Offshore	125 388	56 124	6	2	47.85	35.64
Nova Scotia Offshore	—	—	—	—	—	—
Total	**781 439**	**346 068**	**15**	**6**		

* *Estimated.*

Well Control Problem at Immiugak N-05

COGLA investigated the Immiugak N-05 well control problem and published a report in December. The investigators recommended that operators use all available seismic and drilling data when deciding on the location for a well; that they continue to use pilot holes, reserve mud volumes and diverters in areas where there is a hazard of shallow gas; and that diverters be specially designed for each MODU. The report also recommended a workshop for northern operators be held in 1990 to discuss methods and equipment for drilling safely through suspected shallow gas zones.

Abandonment of Briggs Well

In January COGLA contracted Petro-Canada to abandon properly the Briggs N.E. Tathlina Lake No. 1 well in the Northwest Territories. Drilled in 1956, this well had leaked small amounts of sour gas in recent years. Usually the original operator must correct deficiencies in a well abandonment. However, in this case the operator had been out of business for several years. COGLA inspectors surveyed the drill site and found measurable amounts of hydrogen sulphide, a potential hazard to humans and wildlife, so temporary warning signs were erected to keep the public away from the site. The well was reentered and the hole cemented to the surface.

Protection of the Worker

Helicopter simulator used for underwater escape training of offshore personnel. Courtesy Survival Systems Ltd.

Research and Development

Under the Panel for Energy Research and Development (PERD), COGLA continued to chair the Task 6.2 Marine Engineering Committee, which funds programs in environmental design criteria, marine engineering, ice-structure interaction and personnel safety. These programs address problems in designing and operating oil and gas exploration and production facilities. Research results will improve technologies in the oil and gas industry and will enhance the safety requirements of regulations and guidelines.

The major projects sponsored by PERD and managed by COGLA are described below.

Spray Ice Island Protection

COGLA participated in a joint government-industry field research program that was designed to extend the life of artificial ice islands built for normal exploration or relief well drilling. The project determined the surface ablation and erosion rates, and investigated the stability of the edges of spray ice islands after various protection systems are implemented.

The project was conducted on the *Nipterk* P-32 artificial spray ice island, and assessed many insulation and protection techniques. The results are expected to allow industry to design ice islands that can be used for longer periods, and that have improved design safety features.

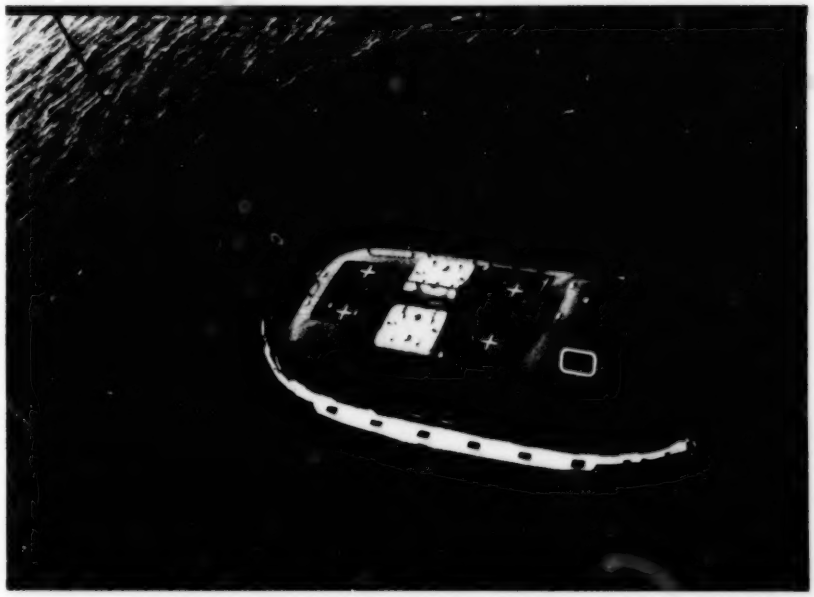
Wave Effects on the Seabed

COGLA began this project to improve physical and numerical modeling techniques for predicting erosion and seabed response around caisson-type structures. The 1989 program focused on developing software to predict pore pressure fluctuations and sediment suspension around the front of the caisson. The new software is being calibrated with laboratory model tests. Industry and government will use the software to design and review caisson-type structures in the Beaufort Sea.

Evacuation Technology

Because offshore drilling units are primarily evacuated by helicopter, two studies were conducted to address various aspects of helicopter passenger safety. In 1989 a two-year study was completed on factors that impede and promote a passenger's escape from a downed flooded helicopter. A second program assessed simple devices that improve a passenger's chances of surviving an offshore helicopter accident.

Another project involved assessing whether having motion sickness for prolonged periods of time (36 hours) endangers the lives of those who evacuate drilling units in totally enclosed motor-propelled survival craft. The results indicated that seasickness leads to dehydration and a loss of body electrolytes, but is unlikely to cause death directly.



The totally enclosed motor-propelled survival craft was the subject of a motion sickness study undertaken by COGLA. Courtesy, S. Gill.

Polar Lows

Although much work has been done on predicting polar lows and their occurrence over the Barents and North seas, little is known about their occurrence, frequency and behavior over Canadian waters. In 1989 COGLA sponsored a new three-year project to study polar lows over Canadian waters. A meteorological database of polar lows events was developed, as well as a climatology of these rapidly developing storms over Canadian waters. This work will be used to prepare a forecaster's handbook to help predict polar lows, which will improve the safety of offshore operations.

Protection of the Environment

Polar bears on Ellesmere Island in the High Arctic.
Courtesy, Canadian Parks Service, Environment Canada

East Coast

Georges Bank

Consistent with a 1988 moratorium on offshore drilling on Georges Bank until the year 2000, COGLA met with participants of the Canada-U.S. Georges Bank Consultative Network to discuss environmental and socioeconomic concerns about drilling on Georges Bank. Participants exchanged information on environmental, scientific and technical research initiatives now under way in both countries.

West Coast

Environmental Review

The Pacific Environmental Coordinating Committee (PECC) met during the year to establish priorities for several study initiatives on offshore exploration. The committee awarded a contract to develop a coastal resource and sensitivity information system.

The Socio-Economic Advisory Committee (SEAC), jointly chaired by representatives from the B.C. Ministry of Energy, Mines and Petroleum Resources and COGLA, met to develop a formal work program. Both SEAC and PECC continued to address environmental and socioeconomic recommendations made by the West Coast Offshore Exploration Environmental Assessment Panel.

North

Isserk I-15 Public Review

In October COGLA participated in the Inuvialuit Environmental Impact Review Board (EIRB) public hearings in Tuktoyaktuk to review the proposed Esso Chevron et al. Isserk I-15 drilling program. It was the first public review by EIRB in accordance with the Inuvialuit Final Agreement. The review focused on the government's enforcement of same-season relief well drilling policy, concerns about oil spill cleanup efficiency and compensation for any harm to wildlife harvest. The board concluded that the project could begin under several specific conditions, which were incorporated into the drilling program approval of the Isserk I-15 well. The board also recommended measures to encourage the participation of the Inuvialuit people in development projects.

Land-Use Planning

During 1989 COGLA worked closely with the Mackenzie Delta-Beaufort Sea and Lancaster Sound Regional Land-Use Planning commissions. COGLA helped review the final draft of the Lancaster Sound Plan, and gave technical and regulatory information on exploration and production operations for the Mackenzie Delta-Beaufort Sea Plan. COGLA also participated in workshops in Inuvik on developing nonrenewable resources. COGLA began discussions with the recently established Denendeh Regional Land-Use Planning Commission over a similar land-use plan for the Dene-Métis settlement area.

Canadian Coast Guard-Beaufort Sea Oil Spill Cooperative Summer Exercise

COGLA inspected the field exercise in Tuktoyaktuk staged jointly by the Canadian Coast Guard and the Beaufort Sea Oil Spill Cooperative. The exercise demonstrated various types of oil spill equipment, including the testing of a new heli-torch capable of igniting oil. The exercise revealed that the personnel involved in the exercise were competent, well trained and familiar with all oil spill countermeasure equipment.

Major Pollution Incident Workshop

COGLA and other federal and territorial agencies held a planning workshop in September for a major pollution incident in the Arctic Seas Region. The agencies reviewed contingency plans of the key government agencies and resource departments to determine whether coordination provisions were adequate, and to identify possible improvements. Future consultations are being considered to improve coordination among agencies.

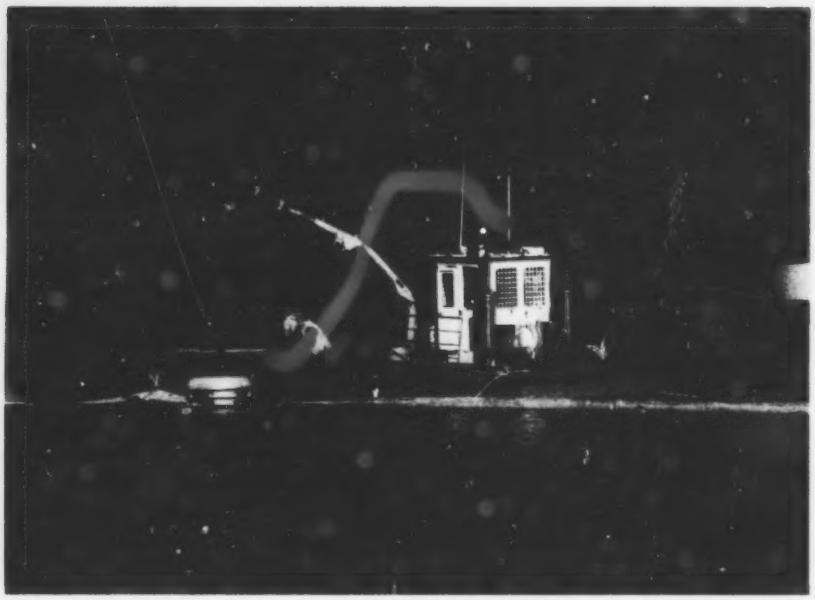
COGLA personnel at the EIRB public hearings on the Esso Chevron et al. Isserk F-15 drilling program. Courtesy, F. Lepine

Consultations

Guidelines

In consultation with government departments, oil and gas boards and the industry, COGLA published the Offshore Waste Treatment Guidelines for offshore hydrocarbon exploration and development. The Drilling Fluids Lubricant Task Force will also publish in the new year its report on the environmental effects of using diesel oil as a drilling fluid lubricant. COGLA continued to consult with the oil industry in 1989 to develop strategies for oil-spill monitoring.

Protection of the Environment



Seatruck assisting in the deployment of boom and skimmer during the Beaufort Sea summer oil spill exercise.
Courtesy, Department of Fisheries and Oceans.

Tanker Safety and Pollution Response Capability

During 1989 the federal government began an interdepartmental review of tanker safety and pollution response capability. The same terms of reference were given to the three-member Public Review Panel, which solicited input from the public. COGLA was involved in the interdepartmental review as a member of the policy and preparedness teams, particularly in those areas concerning liability and pollution response capabilities in offshore oil and gas activities. As well, COGLA presented relevant data on pollution incidents from offshore drilling operations to the Public Review Panel hearing in Inuvik.

Environmental Studies Research Funds

Begun in 1983, the Environmental Studies Research Funds (ESRF) is a research program pertaining to oil and gas exploration and development, funded by oil and gas interest-holders on Canada's frontier lands. The program is managed by a board of representatives from the industry, the federal government, regional boards and the public, supported by a COGLA Secretariat which administers the program. Michael R. Robertson of Petro-Canada was selected as chairman of the ESRF board. He is the first industry representative to serve in the position.

In 1989 ESRF undertook a $500 000 study program in six areas:

- investigating through a numerical model, possible effects of hydrocarbons on the distribution of Grand Banks fish eggs and larvae;
- examining the potential for tainting commercial species of Grand Banks flatfish in the event of an oil spill;
- designing an environmental effects monitoring program for the Beaufort Sea;
- archiving marine radar data on iceberg detection on the Grand Banks;
- designing an ice scour repetitive mapping program for the Grand Banks; and
- analyzing hindcasting extreme waves in the Beaufort Sea.

Employment and Industrial Benefits

On-land and offshore activities created 2319 jobs in 1989. In the North, 2129 jobs were created; all but 10 were filled by Canadians. On the East Coast Canadians filled 175 jobs out of a total of 190.

In 1989 foreign business groups and governments continued to express interest in the opportunities in Canada's offshore development. Many groups came to Canada to learn more about these opportunities; others formed joint ventures with Canadian companies. COGLA gave presentations to the Association of British Offshore Industries and to Canadian and Norwegian companies that participated in seminars sponsored by the Canada-Norway Offshore Working Group.

Northern Developments

The November call for bids for parcels of lands in the central Beaufort Sea provided the federal, the N.W.T. and Yukon governments an opportunity to work together in implementing benefits provisions of the Northern Accord's agreements in principle. Under these provisions, the territorial governments will monitor northern benefits while the federal government monitors national benefits. With few exceptions, benefits for northern exploration programs are national, since expenditures and labor are concentrated in Western Canada and the North.

The nerve-centre of the Norman Wells oilfield, the Central Processing Facility control room, with operator John Charlie, a native of Fort McPherson, N.W.T. Courtesy, Esso Resources Canada Limited

Megaproject Negotiations

COGLA officials assisted Energy, Mines and Resources in the negotiations of the benefits provisions of four megaproject agreements: Other Six Leases Operation (OSLO), the Vancouver Island Natural Gas Pipeline project, the Lloydminster heavy oil upgrader project and Hibernia.

Employment and Industrial Benefits

TOTAL 1989 PETROLEUM-RELATED EMPLOYMENT ON FRONTIER LANDS

	Total Work Force*	Canadian	Per Cent Canadian
Mainland Territories	675	675	100
Mackenzie Delta and Beaufort Sea	1 431	1 421	99
Arctic Islands and Eastern Arctic Offshore	23	23	100
Newfoundland Offshore	150	136	91
Nova Scotia Offshore	40	39	98
Total	**2 319**	**2 294**	**99**

* *Represents approximate number of jobs created.*

TOTAL 1989 PETROLEUM EXPENDITURES ON FRONTIER LANDS

	Exploration*	Development	Production	Total	Canadian	Per Cent Canadian**
		(millions of $)				
Mainland Territories	24.1	—	—	24.1	22.9	95
Mackenzie Delta and Beaufort Sea	233.2	—	—	233.2	198.2	85
Arctic Islands and Eastern Arctic Offshore	—	—	—	—	—	—
Newfoundland Offshore	29.4	—	—	29.4	17.6	60
Nova Scotia Offshore	0.7	—	—	0.7	0.6	86
Total	**287.4**	**—**	**—**	**287.4**	**239.3**	**83**

* *Includes geophysical expenditures.*
** *Estimates.*

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Frontier Lands

Statistical Summary

ACTIVITY STATUS ON FRONTIER LANDS	1985	1986	1987	1988	1989
Licences/Agreements (ELs/EAs/SDLs) Concluded	5	23	42	105	15
Wells Spudded	99	60	48	25	12
Metres Drilled	207 896	150 404	67 234	54 391	27 014
Wells Terminated	103	70	50	27	10
Significant Discoveries	25	14	1	2	3*
Geophysical Programs Run	55	15	7	27	21
Reflection Seismic km	57 091	11 001	2 756	16 568	21 587
Rig-Months	199	133	41	37	18

* *In addition, results of four exploratory wells remain confidential.*

FRONTIER LANDS RESOURCE INVENTORY	OIL*		GAS	
	Discovered (millions of m^3)	Potential (millions of m^3)	Discovered (billions of m^3)	Potential (billions of m^3)
West Coast	0	50	0	270
Mainland Territories	37.7	95	21.8	312
Mackenzie Delta and Beaufort Sea	256.4	1 112	322.7	1 918
Arctic Islands and Eastern Arctic Offshore	65.7	873	416.4	3 156
Hudson Bay	0	127	0	88
Newfoundland Offshore	235.2	894	148.7	1 649
Nova Scotia Offshore	23.7	318	164.7	663
Total	**618.7**	**3 469**	**1 074.3**	**8 056**

* *Includes condensate.*

OIL AND GAS PRODUCTION ON FRONTIER LANDS	1985	1986	1987	1988	1989
Oil Production (thousands of m^3)					
Norman Wells	949	1 411	1 531	1 728	1 789
Bent Horn	29.5	17.5	34.5	54.9	43.4
Amauligak	—	50	—	—	—
Panuke	—	—	3.7	—	—
Gas Production (millions of m^3)					
Pointed Mountain	226	205	156	154	103
Norman Wells	227	188	163	138	129

Mainland Territories

Statistical Summary

ACTIVITY STATUS	1985	1986	1987	1988	1989
Wells Spudded					
Exploratory/Delineation	15	14	1	3	6
Development	39	14	35	11	—
Total	**54**	**28**	**36**	**14**	**6**
Wells Terminated*					
Exploratory/Delineation	17	14	2	3	4
Development	38	14	36	11	—
Total	**55**	**28**	**38**	**14**	**4**
Metres Drilled	53 924	36 289	31 132	15 778	9 865
Exploratory/Delineation	23 968	24 401	974	7 095	9 865
Development	29 956	11 888	30 158	8 683	—
Geophysical Programs Run	17	7	5	9	9
Reflection Seismic km	5 819	2 095	149	1 729**	1 600

* *In the Mainland Territories, where exploratory operations are generally restricted to the winter months, a well is deemed to be terminated in the year in which it reaches total depth, even though it may be reentered in the following year for testing.*

** *Includes three-dimensional seismic equivalent.*

RESOURCES STATUS	1985	1986	1987	1988	1989*
Discovered Resources**					
Gas (billions of m^3)	21.4	20.3	20.8	20.8	21.8
Oil (millions of m^3)	51.0	51.0	37.2	37.2	37.7
Gas and Oil Production					
Pointed Mountain Gas (millions of m^3)	226	205	156	154	103
Norman Wells Gas (millions of m^3)	227	188	163	138	129
Norman Wells Oil (thousands of m^3)	949	1 411	1 531	1 728	1 789

* *Includes new discoveries and revisions to previous estimates.*

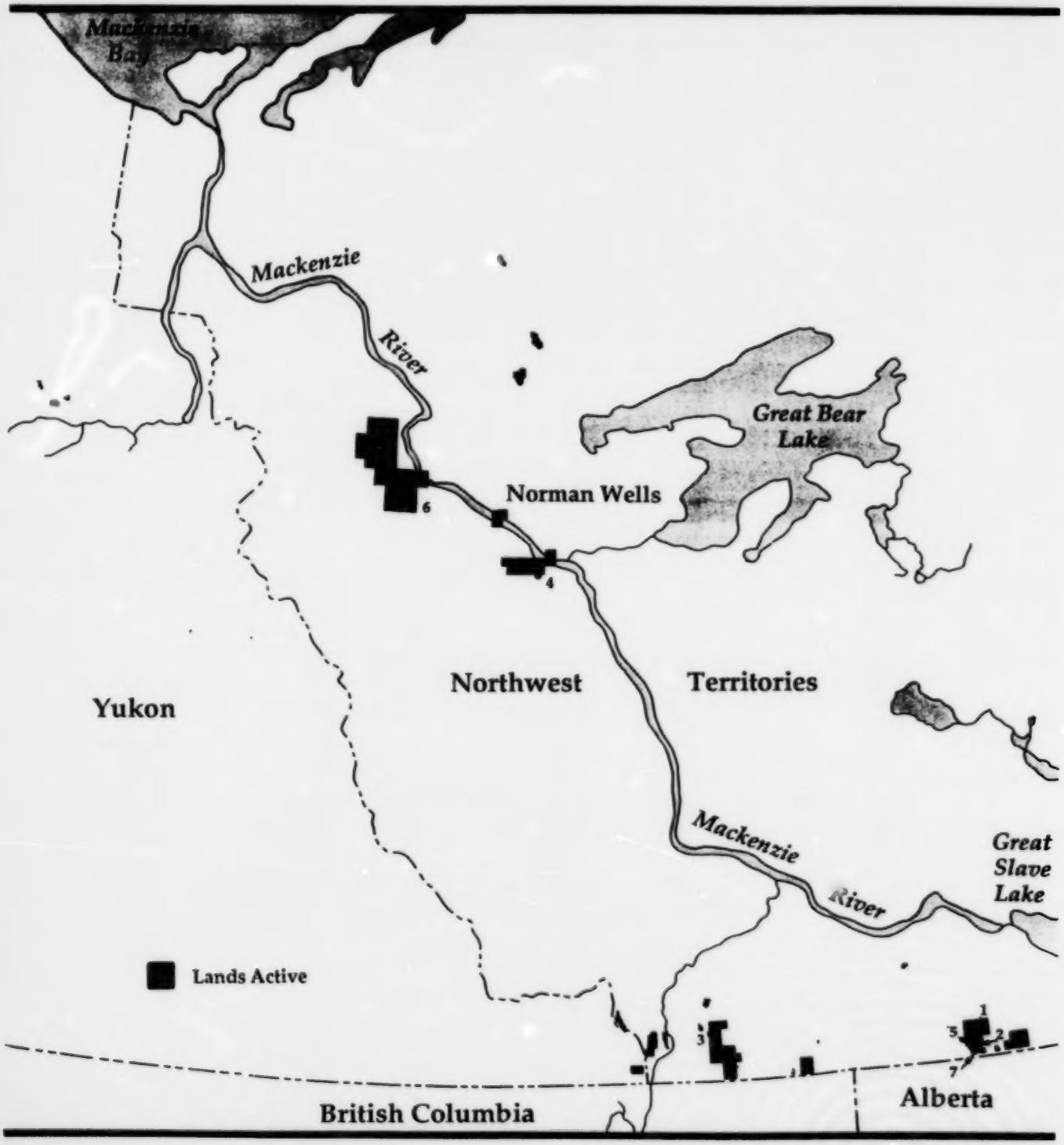
** *As reported in previous years.*

BENEFITS STATUS	1985	1986	1987	1988	1989
Rigs Active	11	11	3	3	5
Rig-Months	31	33	13	6	5
Money Spent (millions of $)					
Geophysical/Geological	60.0	11.1	2.4	8.7	12.6
Exploratory/Delineation Drilling	69.3	54.1	4.4	6.3	11.5
Development Drilling	35.2	14.3	27.0	5.3	—
Production Facilities	23.5	5.6	30.5	5.3	—
Total Money Spent (millions of $)	**188.0**	**85.1**	**64.3**	**25.6**	**24.1**

LAND STATUS	1985	1986	1987	1988	1989
Licences (ELs/SDLs) Concluded	0	0	24	18	0
Total ELs/SDLs Active	34	30	29	30	25
Lands Negotiated into ELs/SDLs (millions of ha)	0	0	4.5	0.08	0
Lands Relinquished/Surrendered (millions of ha)	3.1	3.3	4.7	0.9	0.38
Lands Active (millions of ha)	9.2	5.7	2.3	1.2	0.9

Mainland Territories

Statistical Summary



Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	Paramount et al. Cameron Hills I-10	60°09'39"N 117°30'04"W	*Arnco #1*	85-02-19 85-04-02		
			Cactus 21	86-01-31 86-03-07		
			Poncho #103	86-03-16 86-03-31		1 563
			Roll'n Rig 31	89-02-05 89-02-22	Plugged & suspended	
2.	Paramount et al. Cameron B-08	60°07'07"N 117°30'46"W	*Sierra 2*	89-01-19 89-02-09		
			Roll'n Rig 31	89-02-23 89-03-09	Plugged & suspended	1 560
			*	89-03-09 89-03-28		
3.	Shell et al. Arrowhead B-41	60°30'08"N 122°53'17"W	*Atco 48*	89-01-22 89-03-24	Plugged & suspended, gas discovery	3 080
4.	Conoco et al. North Little Bear O-51	64°40'57"N 125°54'55"W	*Atco/Equtak 76*	89-02-06 89-02-26	Plugged & abandoned	2 190
5.	Paramount et al. Cameron L-47	60°06'32"N 117°39'12"W	*Sierra 2*	89-02-11 89-03-06		1 565
			Roll'n Rig 31	89-03-12 89-03-21		
			*	89-03-29 89-04-02	Plugged & suspended	
6.	Chevron et al. Mountain River O-18	65°37'58"N 129°02'29"W	*Shehtah 1*	89-11-30	Drilling	1 079
7.	Paramount et al. Cameron L-44	60°03'32"N 117°139'03"W	*Sierra 2*	89-12-29	Drilling	391

* *Tested through separator.*

In 1989 abandonment operations were completed for the following wells:

Briggs N.E. Tathlina Lake No. 1 C-27
Horn River Decalta et al. Trout D-66
Columbia et al. Kotaneelee Y.T. I-48

Mackenzie Delta and Beaufort Sea

Statistical Summary

ACTIVITY STATUS	1985	1986	1987	1988	1989
Wells Spudded					
Exploratory/Delineation	19	17	3	3	5
Wells Terminated*					
Exploratory/Delineation	16	24	3	4	4
Metres Drilled					
Exploratory/Delineation	48 370	48 016	8 344	13 438	11 273
Geophysical Programs Run	8	5	1	7	11
Reflection Seismic km	4 700	4 756	139	11 475**	19 483**

* *In the Beaufort Sea, where operations are seasonal and could take place over a number of seasons for a given well, a well is deemed to be terminated in the year in which it reaches total depth.*

** *Includes three-dimensional seismic equivalent.*

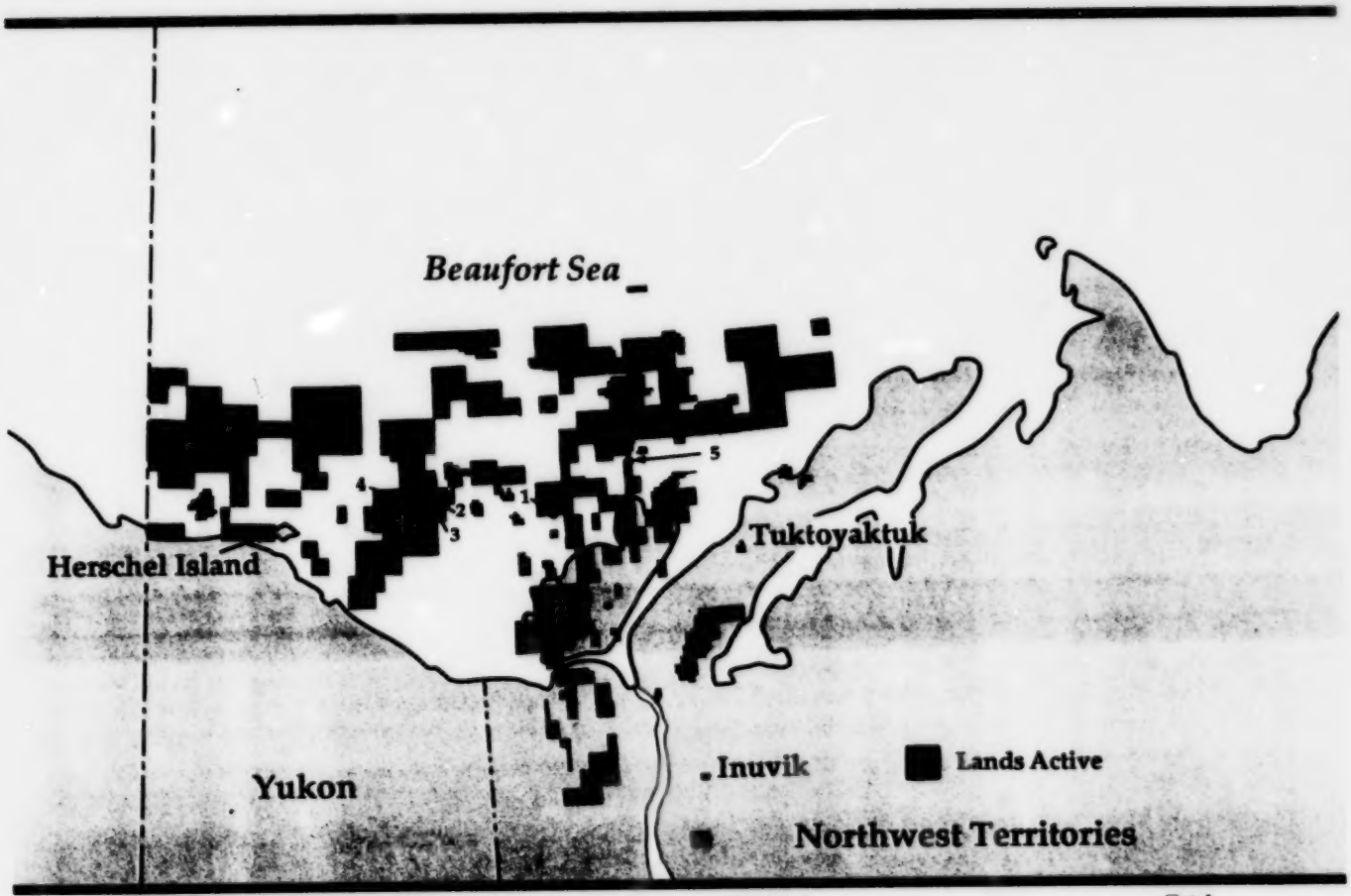
RESOURCES STATUS	1985	1986	1987	1988	1989*
Discovered Resources**					
Gas (billions of m^3)	284.2	292.8	302.1	308.5	322.7
Oil (millions of m^3)	183.1	193.2	253.2	253.2	256.4
Oil Production, Amauligak					
(thousands of m^3)	—	50.4	—	—	—

* *Includes new discoveries and revisions to previous estimates.*

** *As reported in previous years.*

BENEFITS STATUS	1985	1986	1987	1988	1989
Rigs Active	13	11	3	2	4
Rig-Months	43	43	5	10	9
Money Spent (millions of $)					
Geophysical/Geological	38.4	14.6	0.2	27.6	36.6
Exploratory/Delineation Drilling	760.5	391.5	108.6	99	196.6
Total Money Spent (millions of $)	**798.9**	**406.1**	**108.8**	**126.6**	**233.2**

LAND STATUS	1985	1986	1987	1988	1989
Licences (ELs/SDLs/PLs) Concluded	0	0	11	49	7
Total ELs/SDLs/PLs Active	23	23	28	59	62
Lands Negotiated into ELs/SDLs (millions of ha)	0	0	2.1	1.4	0.2
Lands Relinquished/Surrendered (millions of ha)	1.6	3.1	1.4	2.1	1.4
Lands Active (millions of ha)	7.3	4.2	2.9	3.4	2.5



Map No.	Name of Well	Latitude, Longitude	Drilling Unit	Spudded, Reentered, Terminated	Status, Results	Total Depth (m)
1.	Esso Chevron et al. Nipterk P-32	69°41'47"N 135°22'44"W	*Esso 2*	89-02-21 89-04-20	Plugged & abandoned, oil and gas discovery	2 136
2.	Gulf et al. Immiugak N-05	69°44'53"N 137°01'21"W	*Kulluk*	89-06-01 89-06-10	Junked & abandoned	397
3.	Gulf et al. Immiugak A-06	69°45'02"N 137°00'20"W	*Kulluk*	89-06-18 89-07-27 89-09-01 89-09-24	 Plugged & abandoned	 3 800
4.	Amoco et al. Kingark J-54	69°43'44"N 137°28'15"W	*Explorer 1*	89-07-18 89-10-10	Plugged & abandoned	2 247
5.	Esso Chevron et al. Isserk I-15	69°54'44"N 134°17'57"W	*Molikpaq*	89-11-11	Testing	2 693

Arctic Islands and Eastern Arctic Offshore

Statistical Summary

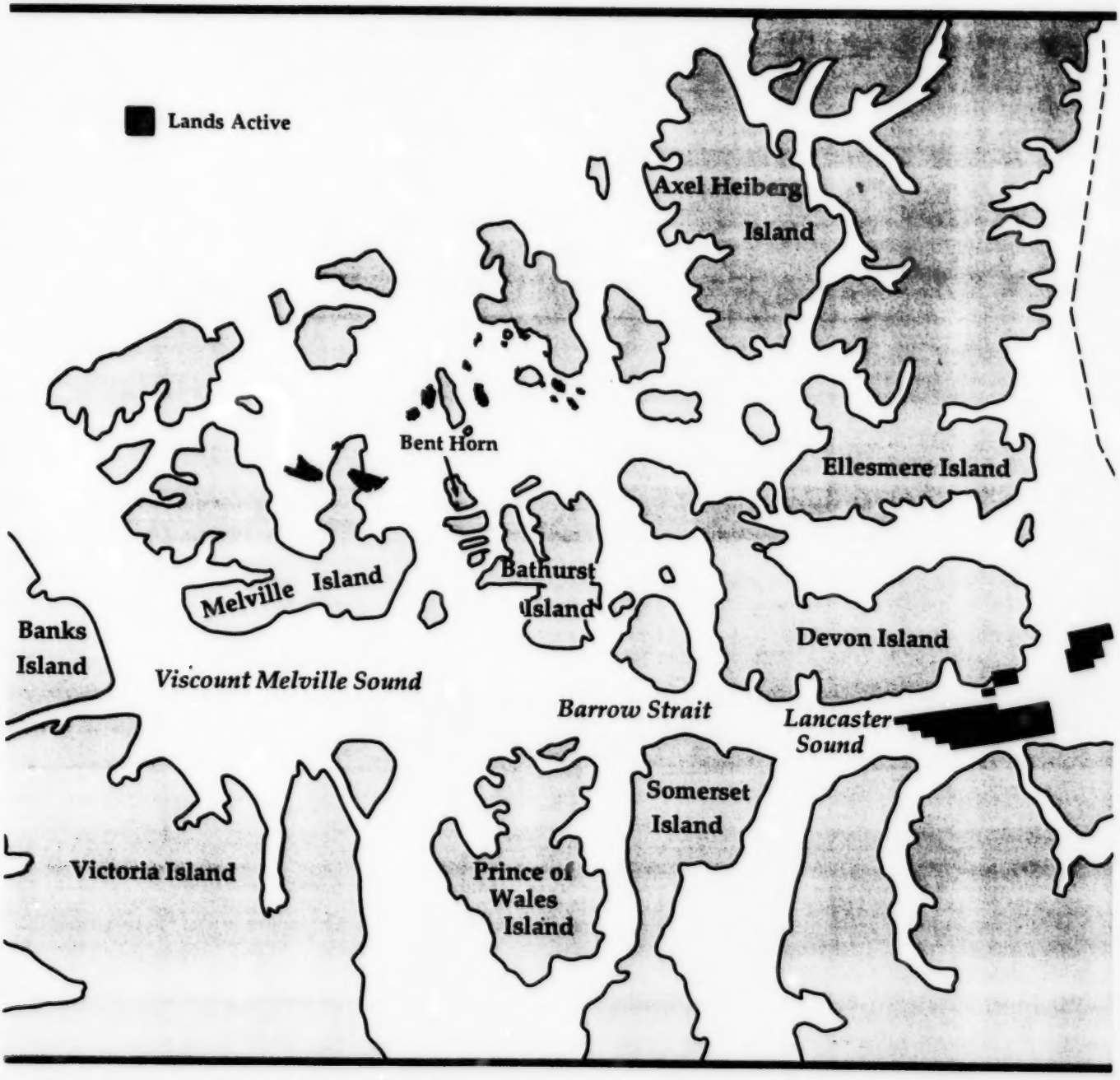
ACTIVITY STATUS	1985	1986	1987	1988	1989
Wells Spudded					
Exploratory/Delineation	3	2	1	0	0
Wells Terminated					
Exploratory/Delineation	3	2	1	0	0
Metres Drilled					
Exploratory/Delineation	6 185	4 940	689	0	0
Geophysical Programs Run	0	0	0	0	0
Reflection Seismic km	0	0	0	0	0

RESOURCES STATUS	1985	1986	1987	1988	1989
Discovered Resources*					
Gas (billions of m^3)	415.7	416.4	416.4	416.4	416.4
Oil (millions of m^3)	65.7	65.7	65.7	65.7	65.7
Oil Production, Bent Horn (thousands of m^3)	29.5	17.5	34.5	54.9	43.4

* *As reported in previous years.*

BENEFITS STATUS	1985	1986	1987	1988	1989
Rigs Active	3	2	1	0	0
Rig-Months	9	4	2	0	0
Money Spent (millions of $)					
Geophysical/Geological	0.2	0	0	0	0
Exploratory/Delineation Drilling	48.0	34.5	8.3	0	0
Production Facilities	7.8	0.6	0.5	0	0
Total Money Spent (millions of $)	**56.0**	**35.1**	**8.8**	**0**	**0**

LAND STATUS	1985	1986	1987	1988	1989
Licences (ELs/SDLs/PLs) Concluded	1	1	3	24	0
Total ELs/SDLs/PLs Active	25	21	16	30	24
Lands Negotiated into ELs/SDLs/PLs (millions of ha)	0.7	0.9	0.3	0.4	0
Lands Relinquished/Surrendered (millions of ha)	1.4	8.9	5.9	0.6	0.17
Lands Active (millions of ha)	15.1	7.5	1.6	1.4	1.29



In 1989 abandonment operations were completed for the Panarctic Tenneco et al. Thor P-38 well.

Nova Scotia Offshore

(including the Gulf of St. Lawrence)

Statistical Summary

ACTIVITY STATUS	1985	1986	1987	1988	1989
Wells Spudded					
Exploratory/Delineation	10	6	3	1	0
Wells Terminated					
Exploratory/Delineation	14	8	3	1	0
Metres Drilled					
Exploratory/Delineation	47 064	29 744	9 583	5 208	0
Geophysical Programs Run	14	2	1	2	1
Reflection Seismic km	26 814	613	195	0	504

RESOURCES STATUS	1985	1986	1987	1988	1989*
Discovered Resources**					
Gas (billions of m^3)	127.4	150.6	160.9	162.4	164.7
Condensate and Oil (millions of m^3)	20.0	22.1	22.9	22.9	23.7
Oil Production, Panuke					
(thousands of m^3)	—	—	3.7	—	—

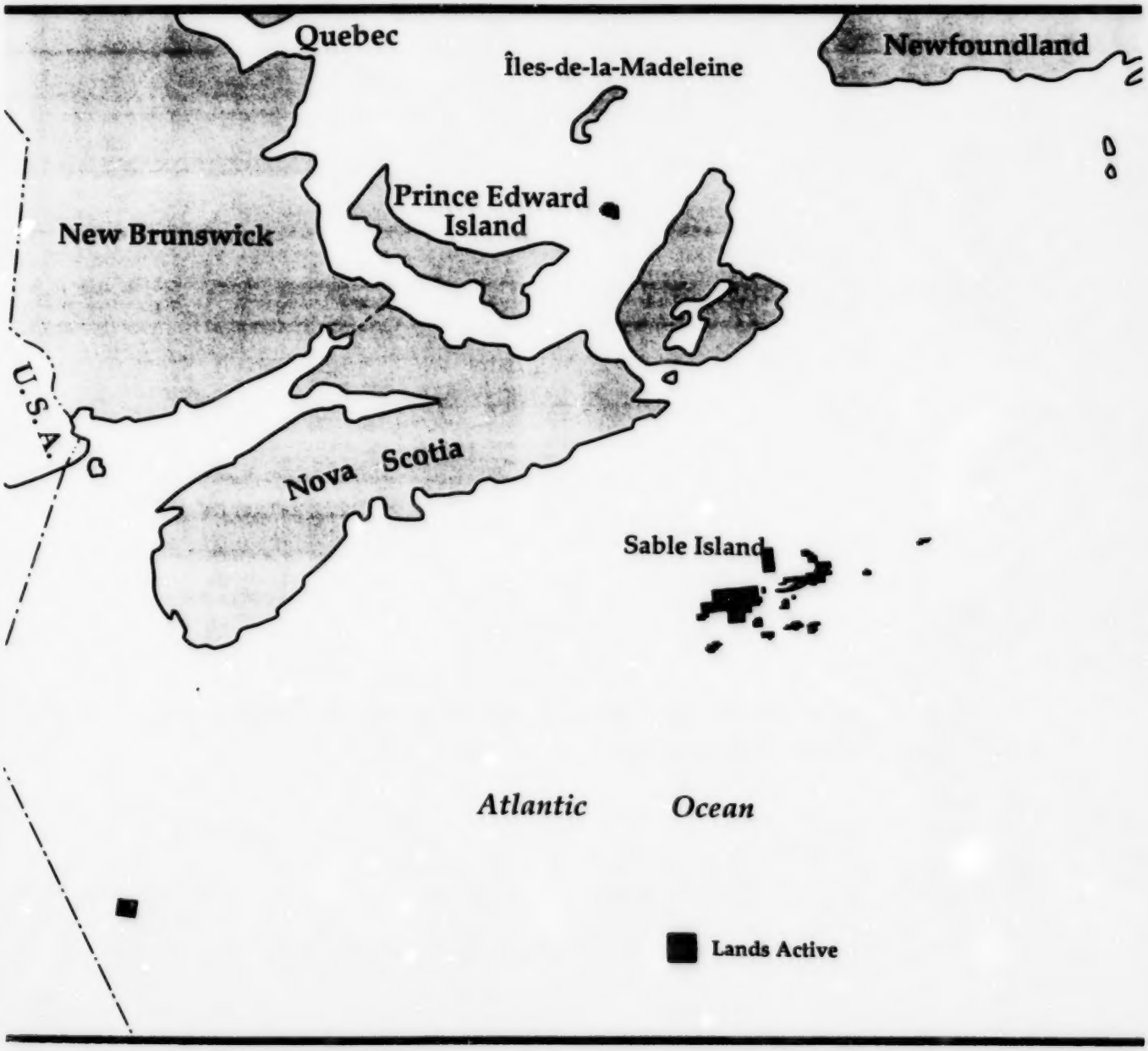
* *Includes new discoveries and revisions to previous estimates.*

** *As reported in previous years.*

BENEFITS STATUS	1985	1986	1987	1988	1989
Rigs Active	8	5	2	1	0
Rig-Months	50	22	5	4	0
Money Spent (millions of $)					
Geophysical/Geological	29.2	0.9	0.2	0.2	0.7
Exploratory/Delineation Drilling	452.0	176.8	35.3	31.5	0
Total Money Spent (millions of $)	**481.2**	**177.7**	**35.5**	**31.7**	**0.7**

LAND STATUS	1985	1986	1987	1988	1989
Exploration Agreements (EAs) Concluded	2	13	3	1	3
Total EAs Active*	28	15	17	15	17
Lands Negotiated into EAs (millions of ha)	0.9	1.7	0.3	0.04	0.1
Lands Relinquished/Surrendered (millions of ha)	2.8	3.2	1.1	0.4	0.12
Lands Active* (millions of ha)	4.2	1.1	0.7	0.3	0.24

* *Includes declared significant discovery areas.*


Quebec
Îles-de-la-Madeleine
Newfoundland
Prince Edward Island
New Brunswick
U.S.A.
Nova Scotia
Sable Island
Atlantic Ocean
Lands Active

Appendix

Newfoundland Offshore

(1986-1989 data verified by the Canada-Newfoundland Offshore Petroleum Board)

Statistical Summary

ACTIVITY STATUS	1985	1986	1987	1988	1989
Wells Spudded					
Exploratory/Delineation	11	7	5	7	1
Wells Terminated					
Exploratory/Delineation	13	8	5	8	2
Metres Drilled					
Exploratory/Delineation	49 098	31 415	17 486	19 967	5 876
Geophysical Programs Run	16	1	0	9	0
Reflection Seismic km	19 758	3 537	0	3 364	0

RESOURCES STATUS*	1985	1986	1987	1988	1989**
Discovered Resources***					
Gas (billions of m^3)	152.4	146.8	146.8	146.8	148.7
Oil (millions of m^3)	185.1	176.5	181.0	212.0	235.2

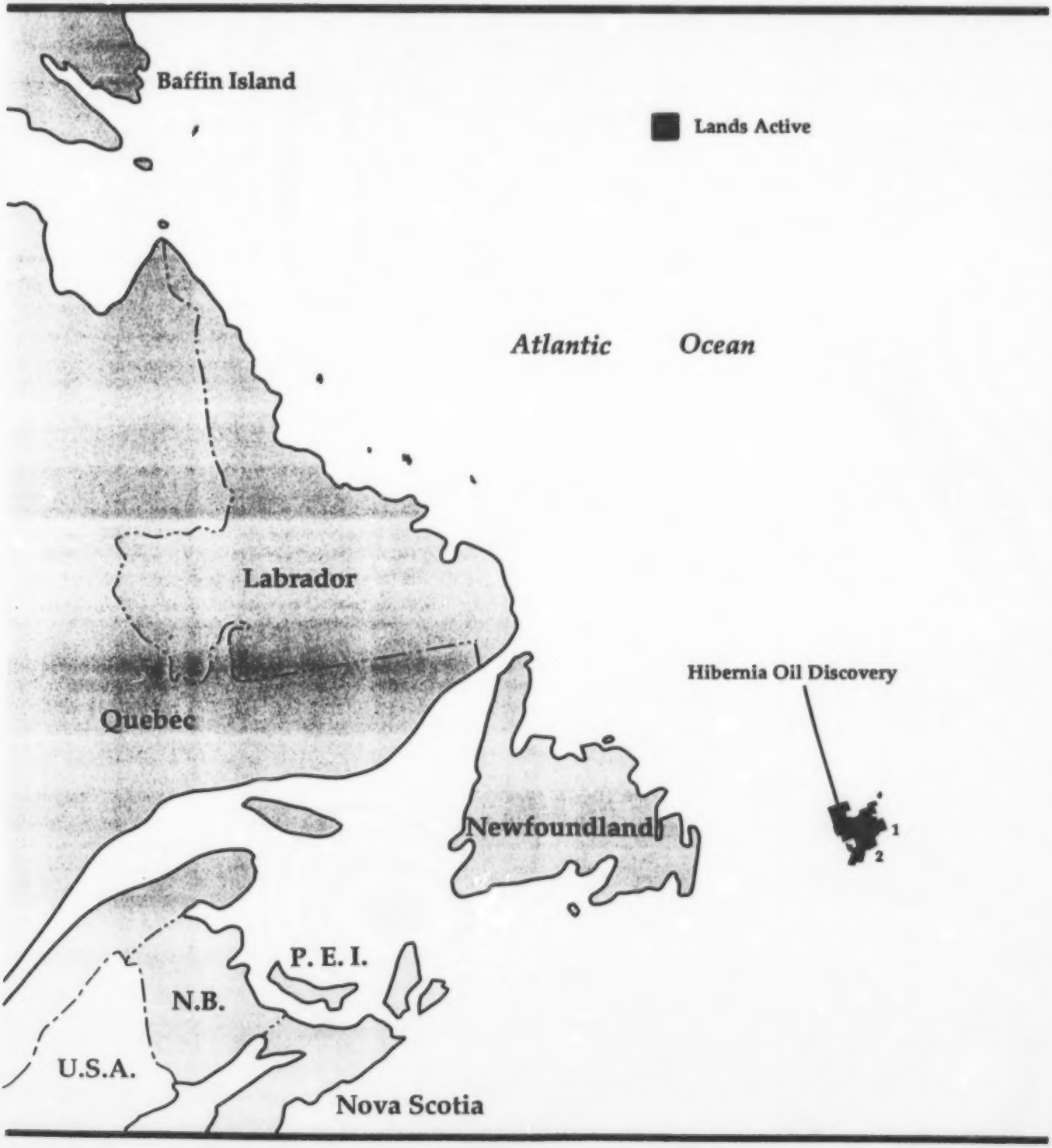
* *These figures have been generated by COGLA and may differ from those published by CNOPB.*

** *Includes new discoveries and revisions to previous estimates.*

*** *As reported in previous years.*

BENEFITS STATUS	1985	1986	1987	1988	1989
Rigs Active	8	6	2	2	1
Rig-Months	63	31	16	17	4
Money Spent (millions of $)					
Geophysical/Geological	27.3	4.1	0	5.2	0
Exploratory/Delineation Drilling	630.0	347.0	200	154.6	29.4
Total Money Spent (millions of $)	**657.3**	**351.1**	**200**	**159.8**	**29.4**

LAND STATUS	1985	1986	1987	1988	1989
Exploration Licences (ELs/SDLs) Concluded	0	9	1	12	5
Total ELs/SDLs Active	38	27	21	19	21
Lands Negotiated into ELs/SDLs (millions of ha)	0	1.5	0.1	0.1	0.26
Lands Relinquished/Surrendered (millions of ha)	10.9	9.2	1.8	1.0	0.3
Lands Active (millions of ha)	11.9	3.4	1.7	0.8	0.76


Baffin Island
Lands Active
Atlantic Ocean
Labrador
Quebec
Hibernia Oil Discovery
1
2
Newfoundland
P. E. I.
N.B.
U.S.A.
Nova Scotia

Newfoundland Offshore

Statistical Summary

Map No.	Name of Well	Latitude, Longitude	Spudded, Drilling Unit	Reentered, Terminated	Total Status, Results	Depth (m)
1.	Texaco et al. Amethyst F-20	46°39'24"N 48°02'28"W	*Maersk Vinlander*	88-12-25 89-02-09	Plugged & abandoned	3 305
2.	Texaco et al. Springdale M-29	46°28'48"N 48°19'28"W	*Maersk Vinlander*	89-02-11 89-03-09		
				89-04-04 89-05-14	Plugged & abandoned, gas discovery	3 192

Glossary of Terms

Abandoned Well: Any well that has been permanently plugged.
Benefits Plan: A plan submitted by operators and approved by the minister that states the employment and procurement intentions of operators related to their exploration and development activities on frontier lands.
Call for Bids: A notice published in the Canada Gazette or other publication, whereby the minister calls for the submission of bids in relation to Crown reserve lands. Formally called a call for proposals under the Canada Oil and Gas Act.
Call for Nominations: A notice inviting interested parties to nominate tracts of lands for potential inclusion in a call for bids.
Completed Well: A well that has been drilled and equipped so that it is capable of producing oil or gas.
Cubic Metre of Gas: Equivalent to 35.301 cubic feet at 14.73 pounds per square inch (760 mm of Hg) of atmospheric pressure at sea level.
Cubic Metre of Oil: Equivalent to 6.2898 American stock tank barrels.
Delineation Well: A well drilled as a follow-up to a discovery well on the same geological feature, with the purpose of determining the extent and commercial potential of the oil or gas accumulation encountered in the discovery well.
Development Plan: A plan that describes the approach and facilities that the proponent intends to use to recover hydrocarbon resources based on the proponent's interpretation of geology and reservoir characteristics of a field.
Drillstem Test: A test involving temporary completion of a well to evaluate fluid flow rates and to collect fluid samples.
Dry Hole: A well that has failed to find significant amounts of oil or gas.
Exploration Licence: A licence granting the right to explore for, and the exclusive right to drill and test for, petroleum, and the exclusive right to obtain a Production Licence subject to compliance with other provisions of the Canada Petroleum Resources Act (formerly called an Exploration Agreement under the Canada Oil and Gas Act).
Exploration Well: A well drilled on a geological feature where no significant discovery has previously been made (synonymous with wildcat well).
Geotechnics: The field of science that deals with the physical and mechanical properties of soil and rock for engineering purposes.
Hectare (ha): 10 000 square metres (equivalent to 2.47 acres).
Hydrocarbon: A naturally occurring compound consisting primarily of atoms of hydrogen and carbon, in solid, liquid or gaseous form.
Infill Drilling: Drilling of wells between existing wells to better exploit the reservoir.
Injection Well (Injector): A well in which fluids are injected into an underground formation to increase reservoir pressure.
Landfast Ice: Sea ice that forms and remains attached to the shore.
Mobile Arctic Caisson: An annular steel caisson (better known as the *Molikpaq*), with deck dimensions of 75 m X 73 m, which is designed to be set down on an underwater berm.
Mobile Offshore Drilling Unit (MODU): Any vessel capable of engaging in drilling operations for the exploration for, or the exploitation of, resources beneath the seabed.
Primary Objective: The subsurface reservoir section thought to be the most likely to contain petroleum.
Reflection Seismic: The primary geophysical technique used in petroleum exploration for mapping subsurface geological features. Acoustic pulses created at the surface are reflected from layers that have different acoustic properties within the earth. The pulses are recorded at the surface for processing and interpretation.
Rights Issuance: The process of granting industry rights to Crown reserve lands subject to the Canada Petroleum Resources Act.
Second Generation Exploration Licence: CPRA provides for the issuance of exploration licences for a maximum term of four years where exploration agreements, issued under the previous legislation, were in existence on 20 December 1985. Those explorers who fulfilled their work requirements under the initial exploration agreements received "second generation" exploration licences.
Significant Discovery: A discovery indicated by the first well on a geological feature that demonstrates by flow testing the existence of hydrocarbons in that feature and suggests the existence of an accumulation that has potential for sustained production.
Sour Gas: Natural gas that contains dangerously high concentrations of hydrogen sulphide and sulphur dioxide.
Suspended Well: A well in which drilling or production operations have temporarily ceased.
Terminated Well: A well that has reached total depth and has been abandoned, completed or suspended.
Waterflood: A method of recovery in which water is injected into a reservoir to remove additional quantities of oil from the reservoir.

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Canada